UPPER TRISHULI-1 HEP (216MW)

Client	**Nepal Water and Energy Development Company Private Limited**
Owner's Engineer	**Tractebel Engineering GmbH / Jade Consult**

REVIEW NOTE

Contractor	**Doosan Heavy Industries & Construction Co., Ltd.**		
Title of the Document	Excavation and Initial Support Drawings of Adit No. 3		
Document No.	UT1-C-150-CVL-DG-43004-01, UT1-C-150-CVL-DG-43004-02, UT1-C-150-CVL-DG-43004-03, UT1-C-150-CVL-DG-43004-04	Revision	E
Date of Documents	10.12.2021	Received Date	21.12.2021
Transmittal Form No.	UT1-HEP-DHI-D-0095		
Previous Review Date/Status	27.12.2021/RR	Prev. Review Note No.	RN-0040
Review Note No.	**RN-0051**	**Present Review Date**	**26.01.2022**
		Present Review Status	**AN**

A: Approved AN: Approved as Noted RR: Returned for Resubmission FI: For Information, only.

General Comments

As previously noted, it is recommended that a separate drawing is produced for the junction of Adit No. 3 with the Headrace Tunnel. The adit needs to be enlarged to the vertical size of the Headrace Tunnel shortly before entering the junction. This is necessary to drive the Headrace Tunnel "full face" from the junction towards upstream and/or downstream. Otherwise, additional, time consuming reprofiling of the junction and the Headrace Tunnel at the junction is required, which shall be avoided. Likewise, the junction needs a support that is designed for the junction and its effective span.

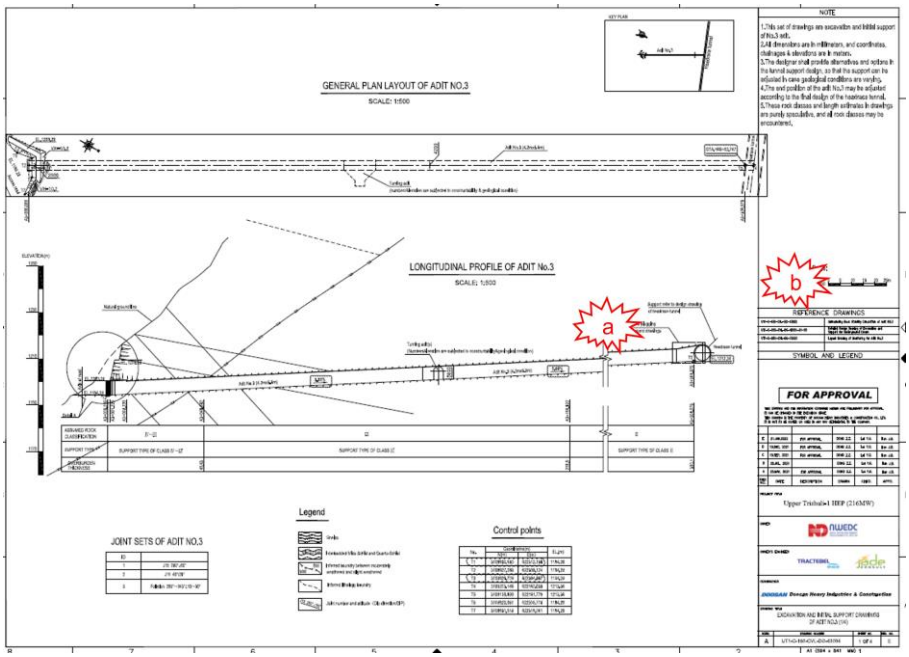
In addition, a concrete plug will be placed in the adit close to the junction - later in the project. For this reason, it is of great advantage to open the adit to the required "plug profile" when driving the adit towards the junction. If this is not done, the excavation profile may need to be enlarged in the section of the plug. The support of the adit (shotcrete and dowels) may also need to be removed in this section prior to grouting and placing the concrete plug, if this section is not opened to the "plug profile" when driving the adit towards the junction.

The main items which need still revision are:

- **Shotcrete strength for the tunnel shall be C25.**
- **Class II requires systematic bolting above the springline in addition to the 50 mm PFRS.**
- **Turning Bay needs to be properly designed (shotcrete thickness, pattern/length of rock dowels).**

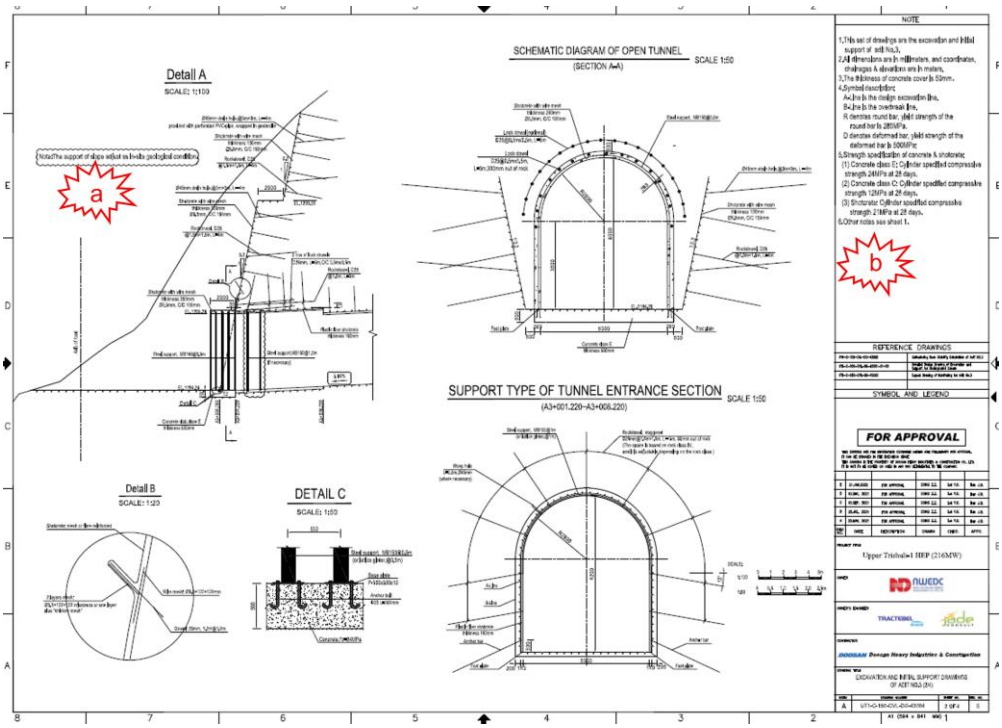
Prior to construction, the drawings shall be revised and resubmitted with the incorporated comments. The drawings are marked and commented.

Drawing UT1-C-150-CVL-DG-43004-01, Rev. E



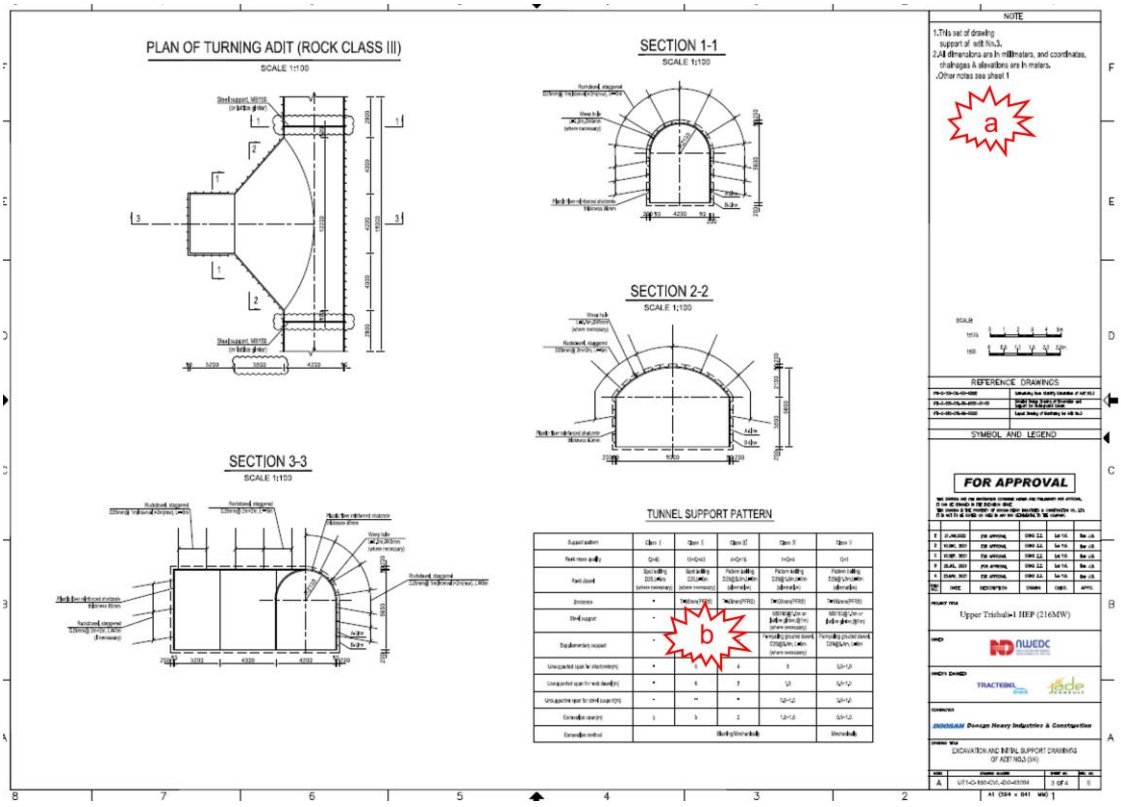
a) Make reference to new drawing of plug/junction with Headrace Tunnel.
b) Add new drawing in list.

Drawing UT1-C-150-CVL-DG-43004-02, Rev. E



a) Delete this comment on geology as this is always the cae.
b) Change shotcrete strength to C25.

Drawing UT1-C-150-CVL-DG-43004-03, Rev. E



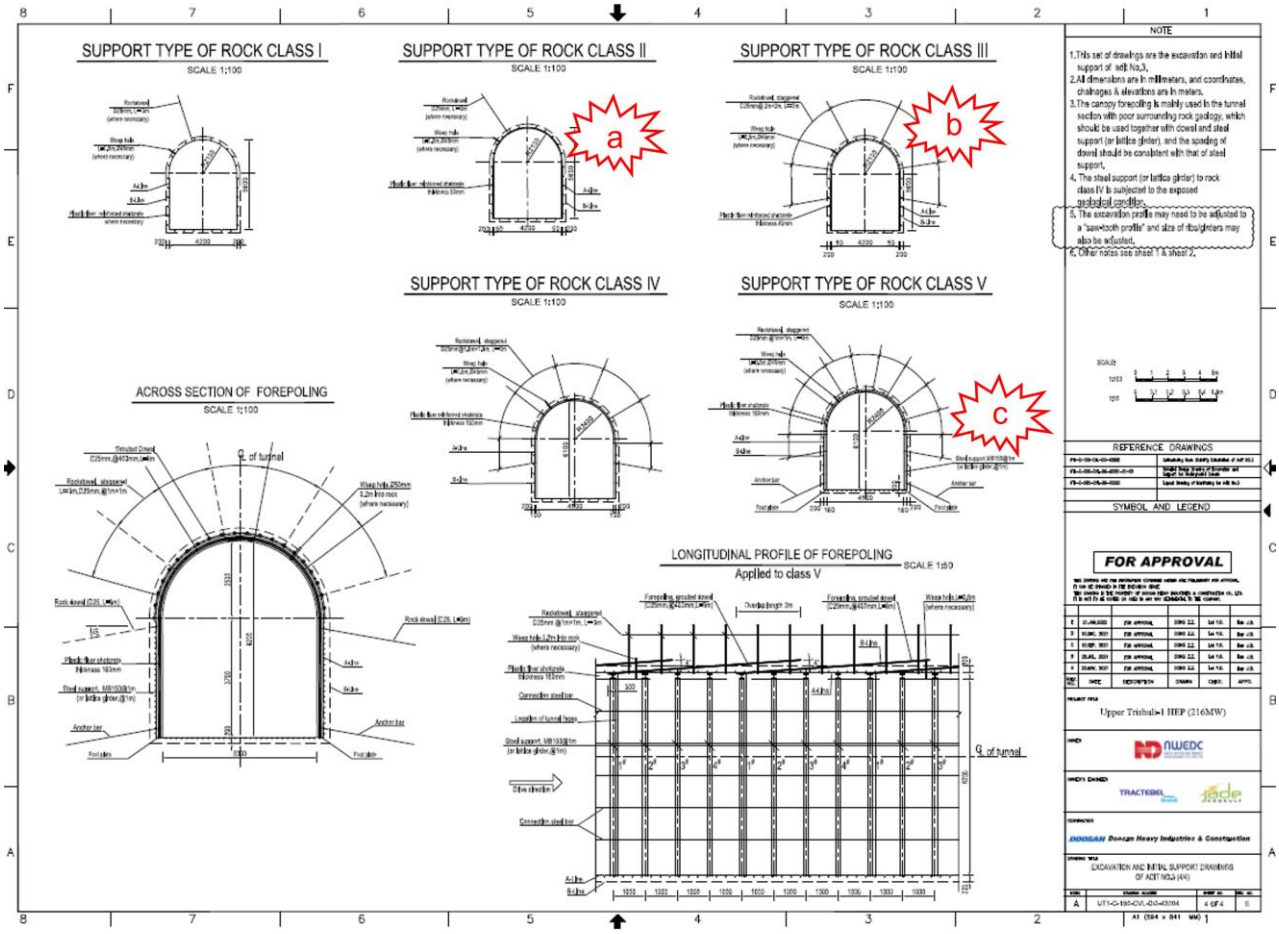
a) Add a note that the Turning Bay requires (re-)design regarding shotcrete thickness and rock bolt pattern/length **prior** to opening the bay or submit such design and add the findings in the drawing.
b) See separate notes below.

TUNNEL SUPPORT PATTERN

Support pattern	Class I	Class II	Class III	Class IV	Class V
Rock mass quality	Q>40	10<Q<40	4<Q<10	1<Q<4	Q<1
Rock dowel	Spot bolting D25,L=3m (where necessary)	Spot bolting (where necessary)	Pattern bolting D25@2.0m,L=3m (alternative)	Pattern bolting D25@1.5m,L=3m (alternative)	Pattern bolting D25@1.0m,L=3m (alternative)
Shotcrete	-	T=50mm(PFRS)	T=80mm(PFRS)	T=100mm(PFRS)	T=160mm(PFRS)
Steel support	-	-	b	MB150@1.0m or (lattice girder,@1m) (where necessary)	MB150@1.0m or (lattice girder,@1m)
Supplementary support	-	-	-	Forepoling grouted dowel, D25@0.4m, L=6m (where necessary)	Forepoling grouted dowel, D25@0.4m, L=6m
Unsupported span for shotcrete(m)	-	9	4	3	0.5~1.0
Unsupported span for rock dowel(m)	-	6	2	1.5	0.5~1.0
Unsupported span for steel suuport(m)	-	-	-	0.5~1.0	0.5~1.0
Excavation span(m)	3	3	2	1.0~1.5	0.5~1.0
Excavation method	Blasting/Mechanically				Mechanically

a) Class II requires systematic dowel pattern.
b) Shotcrete thickness for Class III in temporary tunnels 80 mm, in permanent tunnels 100 mm (as previously in Class IIIb).
c) Class III: for shotcrete 2.0 m, for dowels 4.0 m.
d) Class IV: for shotcrete 1.5 m, for dowels 3.0 m.

Drawing UT1-C-150-CVL-DG-43004-04, Rev. E



e) Systematic dowels in roof.
f) Shotcrete thickness for Class III in temporary tunnels 80 mm, in permanent tunnels 100 mm (as previously in Class IIIb).
g) Dowels in sidewalls need to be spaced narrower to take moments from steel rib.

Dr. Ulrich Glawe